Article

Assessing City Governance for Low-Carbon Mobility in London

Paul Drummond

UCL Institute for Sustainable Resources, Central House, London WC1H 0NN, UK; p.drummond@ucl.ac.uk

Abstract: City-level decisions are crucial for delivering a low carbon transition, particularly as urban population dynamics and environments change in response to the COVID-19 pandemic. Ensuring appropriate governance structures, mechanisms and resources to facilitate these decisions is therefore essential. Based on a systematic literature review by van der Heijden (2019), this paper develops a simple framework to assess the state of ten enabling factors for effective urban climate governance, and applies it to low-carbon passenger mobility in London. Drawing on documentary evidence and a series of semi-structured expert interviews, it finds that London's city authorities have a strong capacity for autonomy, stakeholder participation, local leadership and coordination on climate action and mobility, of which they make extensive use. The national legal and political framework remains broadly supportive following the UK's departure from the EU, but multi-level co-ordination is thin, and funding issues have intensified conflict over political jurisdiction since the pandemic began. Spatial variation in urban form and infrastructure, coupled with dual-layer city administration, complicate the socio-political landscape and drive for climate action in mobility.

Keywords: climate change; local government; climate governance; urban transport

1. Introduction

Following existing nationally determined contributions (NDCs) under the Paris Agreement, warming is projected to reach 2.6 °C by the end of the century, with a lack of practical implementation increasing this to 2.9 °C [1]. Although this represents progress, these values remain well above stated goals. In the absence of sufficient action by national decision makers, attention has been increasingly turning to sub-national actors to lead the low-carbon transition, and in particular, those in city governance. This sits alongside other areas of environmental concern and human development in which city-level governance is central, such as tackling air pollution and delivering Sustainable Development Goal 11.

In recent years, a wide literature examining urban climate governance has emerged, with insights across four key research themes systematically reviewed and synthesised by van der Heijden (2019) [2]. One theme concerns the factors that enable effective urban climate governance, from which the author derived a list of eight primary, interacting elements. This paper develops a framework to assess the state of an expanded list of enabling factors in cities and applies it to London, with a focus on the transition to low-carbon passenger mobility in the wake of the COVID-19 pandemic.

Section 2 first presents a brief overview of the enabling factors presented by van der Heijden (2019) [2] and the wider literature, before describing the assessment framework derived from them, and the method used to apply it. Section 3 presents the result of the application of this framework to low-carbon passenger mobility in London. Section 4 concludes.

2. Materials and Methods

2.1. Literature Review

This paper draws (and expands) on eight "enabling factors" for effective urban climate governance derived and synthesised by van der Heijden (2019) [2] from his review of 260 articles published between 2009 and 2018. These factors are briefly summarised in

Figure 1 (dark green boxes). Van der Heijden (2019) [2] suggests no hierarchy between these factors, and a lack of distinct boundaries, with close interrelation between them. He also notes that they are not exhaustive. For this paper, I consider two additional factors, to provide a broader foundation for analysis (light green boxes in Figure 1).
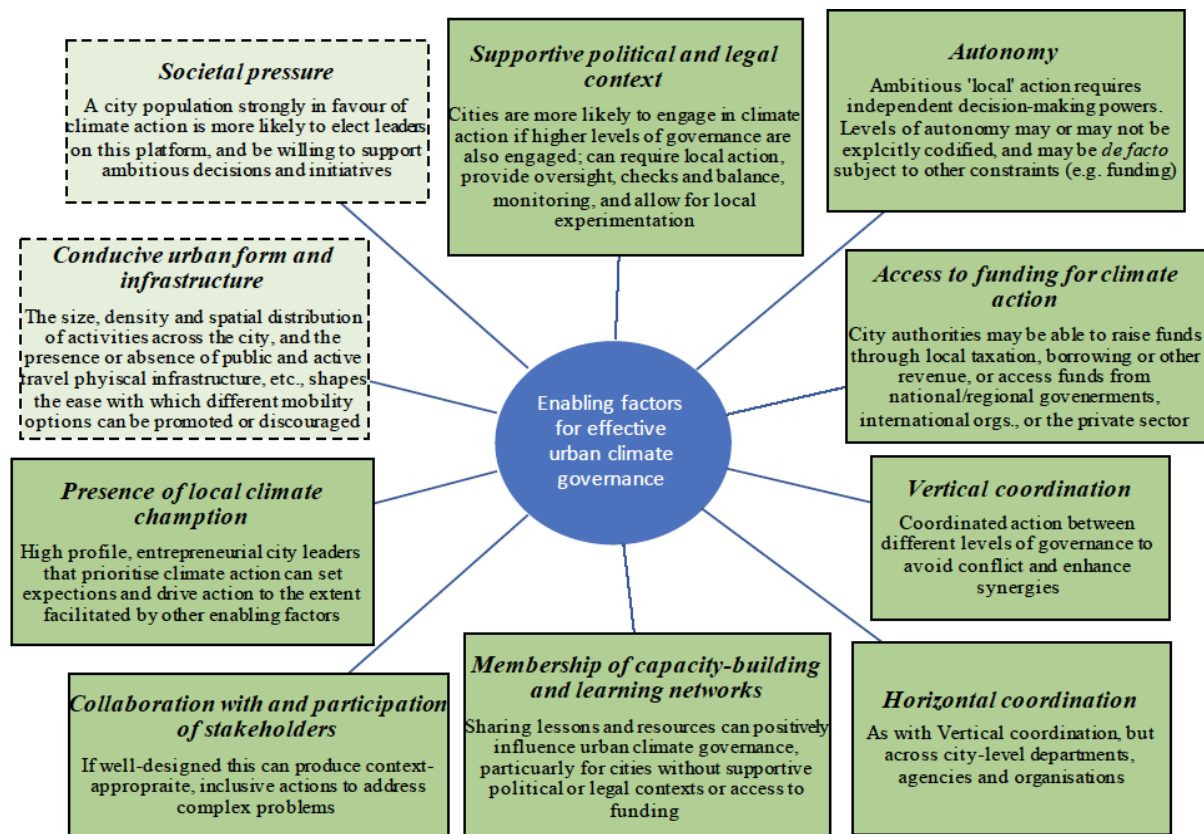

Figure 1. Expanded list of enabling factors for effective climate governance.

The first additional factor is *conducive urban form and infrastructure*. The form of the urban environment strongly influences resource consumption and environmental impact; e.g., large, unicentric cities with low population densities, are likely to have a higher per capita footprint than smaller, polycentric and more densely populated cities—particularly with regard to urban mobility [3–5]. Inherited infrastructure such as metro lines and pavements, or their absence, may also raise or reduce hurdles to different behaviours. The form of a city may thus shape the challenge it faces to deliver decarbonisation, and mediate the transition to achieve it [6]. The second additional factor is *societal pressure*; if the city population is in favour of climate action, measures are more likely to be proposed and successfully introduced. This factor was used by van der Heijden, Luckmann and Cherkasheva—in addition to the original eight—to guide their assessment of the state of urban climate governance in Moscow and Saint Petersburg [7].

Frameworks for assessing the state of city-level governance for other environmental concerns (such as water and waste), for assessing particular strategies for urban climate action, or for climate change adaptation and resilience, have all been developed and applied in the literature (e.g., [8–10]). However, a framework to assess the broad state of urban governance for greenhouse gas (GHG) mitigation, building on a thorough assessment of critical factors, has yet to be developed.

2.2. Assessment Framework

The assessment framework developed and employed by this paper qualitatively scores each of the ten enabling factors presented above, through two inter-related lenses. The first lens assesses the Capacity of a city to take advantage of the enabling factors, and reflects circumstances both within and outside its control. The second lens assesses the extent to which Action has been taken by city authorities to exploit this capacity to drive the transition. Each enabling factor is awarded a Capacity score using a straight-forward four point scale of "weak", "moderately weak", "moderately strong" and "strong", following Sovacool and Van de Graaf [11]. Seven of the ten factors are also provided an Action score with the same scale, with the remaining three—*Supportive political and legal context*, *Conducive urban form and infrastructure* and *Societal pressure*—considered contextual factors, within which the city authorities must operate but cannot easily influence or adjust (at least in the short term). Assigning an Action score to these factors would thus not be appropriate. Table 1 presents the broad criteria applicable to the scores for each lens, for each factor.

Table 1. Score descriptors for enabling factors and assessment lenses.

Enabling Factor		Weak	Moderately Weak	Moderately Strong	Strong
Supportive political and legal context	Capacity	No or limited political, policy or legal support from higher levels of governance.		Clear political, policy and legal support from higher levels of governance	
	Action	*Not applicable*			
Autonomy	Capacity	No or limited ability to introduce substantive policy strategy, decisions and instruments that go beyond those introduced at higher levels of governance, and ability to raise and manage own resources to implement them		Reasonable or extensive ability to introduce substantive policy strategy, mechanisms and instruments that go beyond those introduced at higher levels of governance, and ability to raise and manage own resources to implement them	
	Action	No or limited action has been taken to make use of the autonomy available		Reasonable or extensive action has been taken to make use of the autonomy available	
Access to Funding for Climate Action	Capacity	No or limited ability to use own funds for climate action (either granted or self-generated from e.g., taxation), regardless of level of discretion over how such funds may be used, and/or limited ability to access external funds (due to eligibility, competitiveness, etc.)		Reasonable or extensive ability to use own funds for climate action (either granted or self-generated from e.g., taxation), regardless of level of discretion over how such funds may be used, and/or extensive ability to access external funds	
	Action	No or limited attempts have been made to raise or use funds available for climate action		Reasonable or extensive attempts have been made to raise or use funds available for climate action	
Vertical Coordination	Capacity	No or limited formal or informal processes or actors at any governance level to facilitate vertical co-ordination of climate action		Some or several, clear, formal or informal processes, or dedicated body at the national level responsible for vertical co-ordination of climate action, inclusive of both city and supranational action (if relevant)	
	Action	No or limited use of or attention paid to processes or actors at any governance level for vertical co-ordination of climate action		Reasonable or extensive use of or attention paid to processes or actors at any governance level for vertical co-ordination of climate action	

Table 1. *Cont.*

Enabling Factor		Weak	Moderately Weak	Moderately Strong	Strong
Horizontal Coordination	Capacity	No or limited formal or informal processes for horizontal coordination of climate action within the city		Some or several, clear, formal or informal processes with wide scope, or a central co-ordination body, with high prominence or wide remit, for horizontal coordination of climate action within the city	
	Action	No or limited use of or attention paid to processes or bodies for horizontal co-ordination of climate action		Reasonable or extensive use of or attention paid to processes or bodies for horizontal co-ordination of climate action	
Membership of Capacity-building and Learning Networks	Capacity	No or limited membership of relevant capacity building and learning networks, that the city authorities are eligible to join		Membership of many or most relevant capacity building and learning networks, that the city authorities are eligible to join	
	Action	No or limited engagement with the relevant capacity building and learning networks in which the city is involved		Reasonable or extensive engagement with the relevant capacity building and learning networks in which the city is involved	
Collaboration with and Participation of Stakeholders	Capacity	No or limited formal or informal process for consultation or collaboration with stakeholders and/or no or limited processes to encourage collaboration within and between different stakeholder groups		Some or several, clear, formal or informal process for consultation or collaboration with stakeholders and/or no or limited processes to encourage collaboration within and between different stakeholder groups	
	Action	No or limited use of formal or informal stakeholder consultation or collaboration processes, with no or limited reflection of their outcomes in policy decisions, or reflection of the interests of a narrow range of stakeholders		Reasonable or extensive use of formal or informal stakeholder consultation or collaboration processes, with reasonable or extensive reflection of their outcomes in policy decisions, representing interests of a wide range of stakeholders	
Presence of Local Climate Champion	Capacity	No clear city authority figurehead, or with no or limited public profile and formal or informal power		Clear city authority figurehead (mayor or equivalent) with high profile and reasonable or extensive power within the bounds of city autonomy	
	Action	Mayor or equivalent is hostile or indifferent to climate action		Mayor or equivalent is reasonably or clearly supportive of ambitious climate action	
Conducive Urban form and infrastructure	Capacity	The form of the city, its infrastructure and environs is generally a hinderance to the adoption of key low-carbon technologies and behaviours required for strong climate action		The form of the city, its infrastructure and environs is generally well suited to the adoption of key low-carbon technologies and behaviours required for strong climate action	
	Action	*Not applicable*			
Societal Pressure	Capacity	Residents of the city (individuals and businesses) are generally hostile or indifferent to climate action		Residents of the city (individuals and businesses) generally support or demand strong climate action	
	Action	*Not applicable*			

2.3. Method

The evidence for ascribing scores is drawn from a range of documentary evidence (e.g., legislation, publications by city, national and other authorities, independent reports), and from a series of expert interviews. The interviews took place in September 2020, and were semi-structured around eleven guiding questions to allow free-ranging discussion. The guiding questions focused on each of the enabling factors, and on the role and impact

of the COVID-19 pandemic and measures to mitigate it. The questions are presented in Appendix A. Interviewee responses are anonymised, to allow participants free expression regardless of affiliation.

Table 2 describes the type of interviewees, and assigns each a code. In Section 3, specific quotes or insights from the interviewees are labelled using these codes. For clarity, "City authority" refers to bodies within the Greater London Authority or London boroughs, or their representatives.

Table 2. Coded list of expert interviewees.

Interviewee Number	Interviewee Type
LI-1	City authority
LI-2	London and/or transport-focused NGO
LI-3	City authority
LI-4	London and/or transport-focused NGO
LI-5	City authority
LI-6	London and/or transport-focused NGO
LI-7	London and/or transport-focused NGO
LI-8	Academic

Note: NGO = Non-governmental organisation.

I apply the assessment framework to the governance of low-carbon passenger mobility in London with respect to tackling CO_2 emissions. This includes any mode of land-based passenger transport in the city, and excludes journeys that begin or end substantially outside its boundaries (e.g., intercity road, rail and aviation). Water/marine transport are excluded. Governance factors that target other environmental issues associated with passenger mobility, such as local air pollution, are included only where there is a substantial and clearly positive overlap with CO_2 emissions. Scores for each enabling factor and lens are given in parentheses in section headings.

3. Results

Greater London (London, hereafter) covers 1569 km^2, has a population of 9 million, and produces a quarter of the UK's GDP [12]. A further 1 million people regularly commuted to London to work between 2015 and 2017 [13]. Transport accounted for around a quarter of London's CO_2 emissions in 2017, with private cars responsible for nearly half of this. Private cars, public transport and active transport each accounted for around a third of daily trips in 2018 (Figure 2).

At the height of COVID-19 restrictions in April 2020, road traffic reduced to below 50% of usual levels, whilst bus and London Underground travel decreased over 80% and 95%, respectively. Although by October 2020 road traffic had recovered, bus and Underground travel remained at over 40% and 60% below usual levels. Weekday cycling remained largely stable throughout the pandemic, with increased activity at weekends [16].
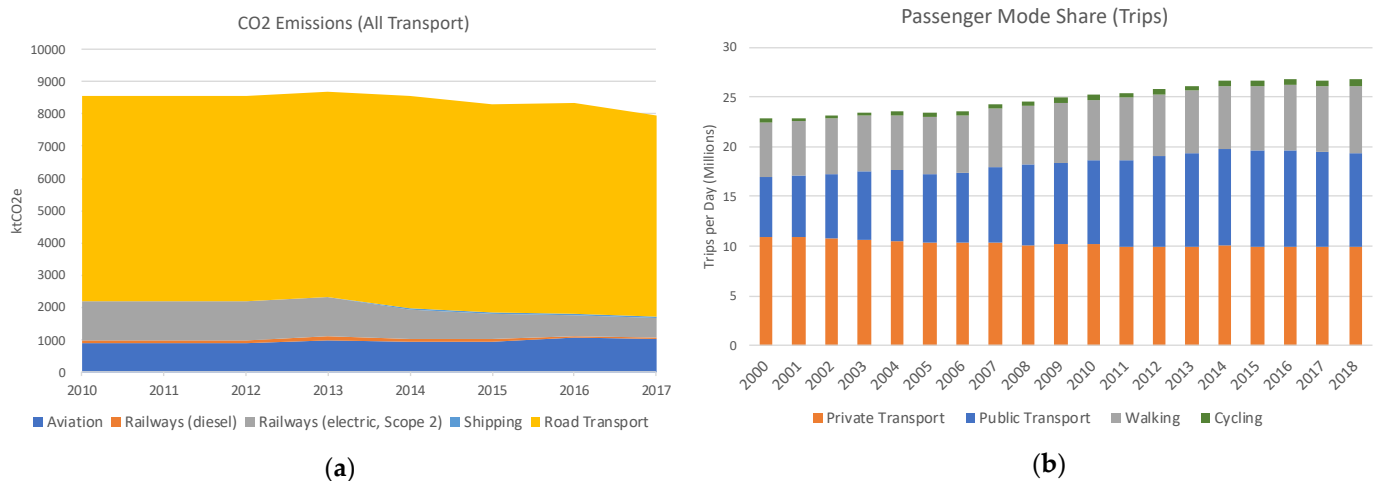
Figure 2. (**a**) CO$_2$ emissions from all transport in London; (**b**) Annual average share of passenger transport mode by trip in London (Data sources: [14,15]).

3.1. Supportive Political and Legal Context (Moderately Strong)

As its capital city, London is within the jurisdiction of the UK government. The UK's 2008 Climate Change Act required the government to reduce territorial GHG emissions by at least 80% below 1990 levels by 2050. In 2019, this was increased to net-zero emissions. The Act also introduces "carbon budgets"; successive five-yearly "caps" on emissions that reduce over time. The government must publish strategies for achieving these budgets. The most recent of these is the Clean Growth Strategy (CGS), published in October 2017 (prior to the net-zero target), which stated that "almost every car and van will need to be zero emission by 2050" [17] (p. 85) In November 2020, the government announced that that a ban on new petrol and diesel cars will take effect from 2030, and hybrids from 2035 [18].

Until 31st December 2020, the UK was subject to the political and legal framework of the European Union (EU), after which all EU legislation remains, or was translated into, UK domestic law. At the time of writing in early 2021, no deviations from such legislation have been introduced. Key EU requirements include fleet-average CO$_2$ intensity regulations on passenger cars and point-of-sale labels presenting information on fuel consumption, CO$_2$ emissions and running costs. In the UK, new cars are also subject to purchase taxes according to CO$_2$ intensity (under vehicle excise duty—VED), ranging from zero (for zero-emission vehicles), to GBP 2175. Thereafter, annual ownership taxes are zero for electric vehicles (EVs), and GBP 150 for gasoline and diesel cars [19]. Purchase subsidies of 35% (up to GBP 3000) for cars with CO$_2$ emissions < 50 g CO$_2$/km, and GBP 7500 for zero-emission capable (ZEC) taxis, are available [20]. Excise (fuel) duty comprises around half total retail prices for gasoline and diesel, although the rate has been frozen in nominal terms since 2010. The reported average CO$_2$ intensity of all new cars in the UK decreased by 17% in 2009–2019 [21], although this is subject to widely reported discrepancies between emissions in test and real-world conditions [22].

The government seeks to "develop one of the best electric vehicle infrastructures in the world" [23], with a policy framework that includes capital grants for domestic, on-street and workplace charging installations [24]. The principal instrument for low-carbon public transport is the Ultra-Low Emission Bus (ULEB) Scheme, a GBP 48 million fund for local authorities to purchase ULEBs and infrastructure. A Cycling and Walking Investment Strategy published in 2017 committed GBP 1.2 billion to associated infrastructure and initiatives to 2021 [25], although a report to Parliament in February 2020 concluded that although committed funding had since doubled to GBP 2.4bn, progress was insufficient [26]. In July 2020, the Government committed an additional GBP 2bn over 2020–2025, setting a target for walking and cycling to be "the natural first choice for many journeys with half of all journeys in towns and cities being cycled or walked by 2030" [27] (p. 12).

The UK's political and legal framework is broadly supportive of low-carbon mobility, however, it "doesn't seem as if all the policies are following through" (LI-5) to achieve stated goals, with "decarbonisation not coherently structured through all policies" (LI-8). Policy on passenger vehicles is generally positive (LI-1 and 6), particularly with the 2030 ban on new gasoline and diesel cars, but the UK is "really lacking in policy to promote active travel, and to encourage public transport use" (LI-3). LI-3, 4 and 7 highlighted that investment in public transport and active travel is dwarfed by the planned GBP 27bn investment in road infrastructure to 2025. Reflecting on the historic role of the EU, LI-8 believed that it remains "relevant through the legacy that has been created", although LI-3 felt that it provided "little more [than] strategic level commitments". LI-7 believes that "since the crisis hit, the government has talked more loudly and more assertively about walking and cycling than we have ever seen any government do", with LI-3 stating that "there does seem to be a real appetite for change, driven by Covid". However, LI-5 cautioned that although this momentum may "put us back on the path" to appropriate support for active travel, "it remains to be seen if this opportunity will be fully grabbed". LI-8 believes that although the national framework is broadly supportive, as it must cater to different regions, it is set at "not quite the lowest common denominator, but more of an average, which offers a number of constraints to more ambitious areas", although they qualify that London has governance arrangements to bypass this that other regions do not. They also believe a fundamental issue to be that the government and civil service "thinks very much in modal terms, and about modes only in competition", rather than their complementarities, in contrast with the approach taken in many other European countries.

3.2. Autonomy

3.2.1. Capacity (Strong)

London is administered by the Greater London Authority (GLA), which consists of the executive Mayor of London and the 25-member London Assembly, both directly elected by the London public every four years. The Assembly scrutinises the mayor's plans, budgets and decisions, and may amend them by a two-thirds majority. The GLA shares administration with 33 local government districts (32 London boroughs, and the City of London—hereafter the boroughs). According to the GLA Act 1999, the principal purposes of the GLA are to promote economic development and wealth creation, social development, and the environment in Greater London. The mayor also has a duty to promote and encourage safe, integrated, efficient and economic transport facilities and services to, from and within London, and must publish the Mayor's Transport Strategy (MTS) to fulfil this duty. The mayor is required to publish six other strategies, including a London Environment Strategy (LES), which must include policies to mitigate climate change, and a spatial development strategy (the "London Plan"). The Act states that the government may only intervene where strategies are inconsistent with national policy, but the government may issue guidance to the mayor for energy and climate policy specifically. The current guidance "encourages the Mayor to innovate, and, where this is possible and reasonable, go further than national policy" [28].

Transport for London (TfL) is a statutory corporation that exists primarily to implement the MTS, and related duties of the mayor. It is responsible for London's public transport infrastructure and services, including buses, the London Underground, Docklands Light Railway (DLR), London Overground, TfL Rail, London Trams, river services, the Santander Cycles hire scheme, the regulation and licensing of taxis and private hire services, and the Transport for London Road Network (TLRN)—major roads that make up around 5% of London's road network by length, but carry around 30% of its traffic. TfL is governed by a board appointed by the mayor, who may also issue guidance and directions as to how TfL exercises its functions [29,30].

The boroughs are usually led directly by elected councillors, who in turn elect a council leader from among their number. However, four boroughs elect an executive mayor for a four-year term, and who may choose a cabinet of councillors. The borough

councils provide the majority of local services, including managing 95% of London's roads, parking enforcement, and acting as the statutory Local Planning Authority [31]. The GLA Act requires boroughs to publish a "Local Implementation Plan" (LIP) to implement the MTS. The mayor must approve each LIP, and may issue guidance for their production. All English Local Planning Authorities must produce a "Local Plan" for spatial development following national planning priorities. For London boroughs, local plans must also conform to the London Plan.

Local government in England is primarily funded from Council Tax and the Business Rate Retention Scheme (BRRS). Council Tax is levied on residential properties based on their value. Local authorities may increase rates, but if this exceeds 2% annually, a local referendum must be held. In London, the GLA also sets a "precept"; a "top-up" rate on council taxes that boroughs collect for the GLA. The BRRS allows local authorities to retain up to 50% of the increase in local revenue generated from national business rates, levied on the occupation of non-domestic property, in exchange for a reduction in direct government funding (which provides much of the remaining local authority funds). In 2018, London joined a national trial for 100% retention in exchange for the removal of the remaining "GLA Transport Grant" provided by the Department for Transport (DfT) to part-fund TfL. This grant had already decreased substantially, from more than GBP 2.8 billion in 2012 to less than GBP 230 million in 2017 [32]. Its removal meant that TfL became one of the only transport authorities in the world to receive no government support for its day-to-day operations (a position altered in practice since the onset of the pandemic, discussed below).

The GLA Act allows TfL to charge for services (with rates set by the mayor), and allows TfL or boroughs (with mayoral approval) to establish road pricing. Revenue must cover the costs of operation, with profits used to support the MTS. Such powers are additional to usual local authority powers, including the ability to designate parking zones and charge for their use. TfL may acquire, develop, sell or lease land, and to provide funds to third parties for activities that contribute to TfL's objectives. Local authorities in England (both the GLA and boroughs in London) may impose a Community Infrastructure Levy on new developments to fund local infrastructure [33], with certain authorities (including the GLA) able to introduce a Business Rate Supplement (BRS) to fund projects to promote economic development. All English local authorities (including the GLA, but also its functional bodies, such as TfL) may borrow funds within national guidelines [34].

The interviewees agreed that transport is "one area in which [the GLA] does have sufficient autonomy" (LI-5), but there are concerns that since the onset of the pandemic this autonomy is being eroded, as discussed below. LI-8 qualified this view by distinguishing different channels of autonomy. They believe that the GLA "has lots of autonomy to formulate its own vision [and] has a fair amount of decisional autonomy, but at the level of implementation, things get a bit trickier". With ownership and control over the public transport network and the TLRN, and as one of the largest landowners in London [35], TfL can take significant unilateral action and use "trial and error to work out the very best" (LI-1) in low-carbon mobility. However, several interviewees felt the key issue to be a lack of funding, and although the removal of the GLA Transport Grant made TfL "incredibly autonomous, because it had to be" (LI-4), fulfilling all its obligations and ambitions became "a great challenge" (LI-2), as discussed further below, and in Section 3.3. The GLA has relatively limited influence over private transport (LI-4 and 6). Although they must work within the GLA policy framework, boroughs have relatively high autonomy to operate within it. This is further discussed below and in Section 3.5, but the "difference in action between different boroughs is dramatic, and indicates that they do have quite a lot of autonomy from the mayor" (LI-7).

3.2.2. Action (Strong)

The current London Plan, published in March 2016, stated an objective that "over the years to 2036—and beyond, London should [lead] the world in its approach to tackling the urban challenges of the 21st century, particularly that of climate change" [36] (p. 31). The majority of

low-carbon ambitions in this Plan relate to energy efficiency; it requires boroughs to promote walking, cycling and low-emission private transport, but with few specific requirements (such as minimum provision of cycle parking for new developments) [36]. A new London Plan will soon come into force, and which has been developed using the principle of "Good Growth"; growth that is "socially and economically inclusive and environmentally sustainable" [37] (p. 11). The focus and requirements of the new Plan are similar to the current iteration, but with greater stringency [37].

An overarching objective of the current MTS and LES is to "turn London into a zero carbon city by 2050" [38,39]. These strategies lay out plans for decarbonising TfL's infrastructure and operations, including a zero-emission bus fleet by 2037; increasing renewable energy generation on TfL's land; reducing operational emissions from TfL's assets and infrastructure; and for TfL-controlled rail services to be zero-carbon by 2030 by using renewable energy [38,39]. Using its ability to set license conditions, TfL will require all taxis and private hire vehicles (PHVs) to be ZEC by 2033 [38]. Other key targets, plans and policy instruments are discussed in Sections 3.3 and 3.8.

In 2019/20, TfL had a projected budget of GBP 10.3bn—over half the total GLA budget [32]. Around 25% of this was to be met by income from the BRRS and council tax precept, and nearly 50% by fare income. Successive mayors, via TfL, have used their road pricing powers to introduce the London Congestion Charge (LCC) and the Ultra-Low Emission Zone (ULEZ), which alongside commercial activities, were to account for 12% of TfL's budget. The LCC is a GBP 15 daily charge for vehicles entering central London (about 1% of Greater London [40]), between 07:00 and 22:00, except low-emission vehicles. Recent changes to the LCC are discussed below. The ULEZ was introduced in April 2019, covers the same area as the LCC (with an expansion planned in October 2021), operates at all times, and charges GBP 12.50 for private vehicles that do not comply with current EU air pollution (EURO) standards. In 2010, the mayor introduced a BRS on the largest 15% of businesses in London, and a Mayoral Community Infrastructure Levy (MCIL). This income, alongside targeted grants from the GLA, government and boroughs, were projected to cover 15% of TfL's budget in 2019/20. The remainder was due to be sourced from cash reserves and borrowing [41].

The onset of the pandemic and measures to address it, including a nationwide "lockdown" with extensive travel restrictions introduced in March 2020, led to a 90% fall in TfL fare income in the months following. In April 2020, bus and Underground service provision decreased by 13% and 59% respectively, due to operational difficulties and service restrictions. Despite substantially reduced demand, efforts were made to resume usual service provision in order to allow for social distancing on public transport for essential travel. Although bus service provision returned to usual levels by July 2020, Underground service provision remained 7% below 2019 levels until at least October 2020 [16]. The mayor also suspended the LCC and ULEZ. These factors led TfL to project a budget shortfall of GBP 1.9bn between April and October 2020 [42]. In May 2020, the mayor agreed an emergency funding and financing package with the government, worth GBP 1.6bn. However, key conditions included: the immediate reintroduction of the LCC and ULEZ; an increase in fares from January 2021; two government-appointed Special Representatives to attend all TfL Board meetings; and a government-led review of TfL's finances [43]. Despite this, TfL projected an additional shortfall of GBP 2bn by the end of 2020, and GBP 2.9 billion for 2021/22 [42]. In November 2020, a second funding deal worth GBP 1.7 billion was agreed, with further conditions including a requirement for TfL to achieve GBP 160 million in savings, and for travel concessions to be funded separately by the mayor. Initial government proposals to extend the LCC to match the upcoming ULEZ extension, and to further increase fares, were not part of the final terms.

Successive mayors, TfL and the wider GLA appear to have made extensive use of the autonomy afforded; a conclusion supported by all interviewees. The mayor's strategies are wide-ranging and ambitious, as discussed in Section 3.8, and supported by specific actions. TfL is "world renowned" (LI-4) and "a resounding success of devolution" (LI-2). The LCC

and ULEZ are "really good examples of where TfL has put its autonomy to great use, and has shown its potential" (LI-5), although both LI-4 and 6 suggested that road pricing is an area where "autonomy could have been leveraged further than it has been" (LI-4) through a more sophisticated (e.g., time or distance-based) approach. LI-1 stated that although TfL has used its substantial land holdings in some areas, such as installing EV charge points, such action is "a bit piecemeal".

Successive mayors and Assemblies have advanced the case for further devolution. In 2012, the mayor (Boris Johnson) established the London Finance Commission (LFC) to investigate greater fiscal devolution. Their report concluded that "devolving revenue streams, including from the full suite of property taxes, will afford London government the autonomy to invest in the capital and increase its accountability to London's residents and businesses" [44] (p. 10). They argue that just 7% of all taxes paid by London residents and businesses is retained by London authorities, whereas in New York, for example, this value is 50%. [44]. The Commission was reconvened in 2016 by Sadiq Khan, and published a new report that proposed allocating to the GLA a proportion of income tax and VAT revenue that would normally accrue to the government [45]. LI-1 also believed further devolution would be of benefit, and stated that if given "the right capability, there is loads more [TfL] could do".

The COVID-19 pandemic has "highlighted how fragile the funding for [TfL] is, because it's so reliant on passenger fares which have been demolished" (LI-5). However, LI-4 believes that the conditions of the emergency financing packages have "created space for the government to leverage slightly more influence over what is ordinarily quite an autonomous transport authority", with LI-1 "very worried that a lot of that independence is going to be lost", with government attempting to "'claw back some autonomy" (LI-6). LI-1 and 8 feel that this in part a political fight between the mayor and government, with the government now having "parked its tanks on the lawn of the mayor" (LI-7). At the borough level, LI-1 felt that although some use their autonomy well, "the majority don't, not remotely", and most "don't do a terribly good job of making use of adopted roads and adopted highways, particularly in restricting use to active travel" (LI-4). LI-5 believed that most boroughs could make more use of their spatial planning powers, and be more assertive with developers to include low-carbon mobility infrastructure. The interviewees broadly agreed that those more likely to put their autonomy to use are the more central boroughs (for reasons discussed in Section 3.9). Elements of borough autonomy are further discussed under Sections 3.3 and 3.5, in particular.

3.3. Access to Funding for Climate Action

3.3.1. Capacity (Moderately Strong)

The ability and discretion GLA (and TfL) have to raise and spend funds are described in Section 3.2. A recent report by the London Sustainable Development Commission (LSDC, discussed in Section 3.5), however, concluded that "the direct spending power of the Mayor is several orders of magnitude less than that necessary to achieve a zero-carbon economy for the capital" [46] (p. 11). In addition, around 87% of TfL's income is required simply to maintain and operate the existing network [47]. Much of the transport-related funding for boroughs is provided by TfL, to implement LIPs. For 2020/21, TfL allocated GBP 200 million for this purpose, of which boroughs have full discretion over less than 2% [48]. LIP funding was paused in 2020 as TfL worked "to meet the conditions in our funding and financing recovery package" [49], but resumed in November 2020. One such condition was the establishment of a GBP 55 million Active Travel Plan for London, including GBP 45 million for boroughs to invest in related infrastructure (with the remaining GBP 10 million for TfL). In May 2020, the government announced a national Active Travel Fund of GBP 250 million, of which London (TfL and the boroughs) was allocated a further GBP 25 million. Other government funds, those described previously, have been available, although London authorities are often ineligible due to their specific devolution and funding arrangements (see Section 3.2). In the LES, the mayor calls on

government to ensure "that London can access national funding on the same basis as other local authorities" [38] (p. 101). However, the government does provide funding for specific, usually large infrastructure projects. A key example is Crossrail (The Elizabeth Line), the largest railway infrastructure project in Europe, for which the government is providing around half the projected GBP 17.6bn cost [50].

LI-7 felt that it was "very clear that the removal of the [GLA Transport] Grant was pretty brutal for TfL" (LI-7), and limited its ability to fund climate action. Although there is a lot of ambition to drive low-carbon mobility (see Section 3.8), "it is difficult to see where the money is going to come from" (LI-2), and TfL are "hampered by inability to invest and plan for the long-term [without] a stable footing to deliver its policy priorities" (LI-2). Interviewees agreed that this situation has worsened with the pandemic, as income for the GLA, TfL and boroughs has "fallen off a cliff" (LI-4). LI-4 believes that "the funding climate is incredibly challenging; a number of boroughs have been running on a very shoestring budget for a number of years".

3.3.2. Action (Strong)

The GLA and TfL make broad use of their ability to raise funds, as discussed in Section 3.2. In addition, in 2015, TfL issued a ten-year green bond, raising GBP 400 million to be invested in public and active travel [46,51]. In January 2020, another issuance was announced, with proceeds allocated to clean transport, pollution control and renewable energy [52]. TfL have also committed to leverage other sources of finance where possible, such as selling surplus land to develop affordable housing, with proceeds allocated to TfL's transport investment programme [39]. In 2018, TfL Consulting was launched to commercialise TfL expertise by partnering with cities and regions around the world. By 2023, it aims to have generated GBP 45 million in revenue [53]. A "fare freeze" introduced by the current mayor in 2016 is estimated to have reduced TfL income by around GBP 640 million by 2020, with concessions costing a further GBP 300 million [47,54]. Alongside ending the fare freeze and reducing concessions, a report by the London Assembly recommended that additional revenue be generated through TfL's advertising capabilities, sponsorship, TfL consulting, constructing and renting properties on its estate, and making efficiency savings. A recent LSBC report recommended the establishment of a London Future Finance Facility, offering a channel for clean investment. Both the London Assembly and LSDC also recommended further devolution of fiscal powers [46,47].

The vast majority of TfL's expenditure may be considered as spending on climate action, as without it, CO_2 emissions from passenger mobility would be higher. The lack of data makes assessing spending with this explicit purpose difficult. However, the mayor has committed around GBP 1.8bn for "Healthy Streets" (see Section 3.3) between 2019 and 2024 [55], most of which is for public and active travel infrastructure. TfL also operate a car and motorcycle scrappage scheme for London residents that receive welfare benefits, to replace vehicles that don't comply with ULEZ requirements [56]. Of the GBP 200 million provided to boroughs for LIP implementation, around GBP 170 million is to be spent on Healthy Streets, including over GBP 60 million for cycling infrastructure [48]. Over time, "TfL has become more and more stringent about how it applies its funding [for boroughs], and has added more and more strings" (LI-7). A range of other grants for boroughs are occasionally available from TfL, such as the Mayor's Air Quality Fund—GBP 22 million to support projects by boroughs to improve air quality, but which is currently closed to new applications [57].

The GLA and TfL have been reasonably successful at receiving government funds to which they can apply. For example, TfL received around 15% of the budget from the ULEB Scheme [58]. In 2016, a collaborative bid between TfL, GLA and London Councils (described in Section 3.5) was awarded GBP 13 million as part of the national GBP 40 million Go Ultra Low Cities Scheme between 2016 and 2020 [59]. The boroughs also receive ad hoc DfT grants, such as GBP 2 million each to provide cycle training in August 2020 [57]. In addition, through the London European Partnership for Transport (LEPT)

operated by London Councils, LI-5 believed that "boroughs had been quite good at getting EU funding, particularly for transport projects", but are now largely ineligible. The interviewees believed that action taken by boroughs to raise funds for climate action varies substantially, largely due to differences in "public views on [low-carbon] modes of transport, and the access they have to TfL's network" (LI-4). Interviewees agreed that inner boroughs, with strong transport connections and which tend to be led by councils of the same political persuasion as the current mayor, are more active, while many of the outer boroughs are "dragging their feet to avoid doing what the mayor wants for as long as possible" (LI-7). However, LI-4 felt that some of the difference "comes down to the different capacities that boroughs have to apply for these pots of money", and that some boroughs have invested in developing strong, highly engaged transport teams over a number of years, allowing them to identify and apply for available funds effectively.

3.4. Vertical Coordination

3.4.1. Capacity (Weak)

The Department for Business, Energy and Industrial Strategy (BEIS) is responsible for developing government strategy to achieve the goals of the UK's Climate Change Act. However, Sasse, Rutter, Shepheard and Norris (2020) find that climate action is not a top priority in BEIS; only one of BEIS' five main objectives relates to this issue ("ensure the UK has a reliable, low cost and clean energy system") [60]. The DfT sets policy and regulation for all modes of transport, including active travel. The Ministry of Housing, Communities and Local Government (MHCLG) is responsible for spatial planning, while the Treasury (the UK's Ministry of Finance) is responsible for tax policy and broad allocations of government budgets. Although the term 'sustainability' is used, none of the key objectives of these departments explicitly reference decarbonisation or its synonyms [61–63]. Despite its coordination role, BEIS holds few levers to compel action by other departments, and there are few cross-departmental processes or bodies dedicated to decarbonisation; a key exception is the Office for Low Emission Vehicles (OLEV), operated jointly by BEIS and DfT, to support the market for ultra-low emission vehicles (ULEVs) [64]. The Climate Change Committee (previously Committee on Climate Change) was created to advise the UK and devolved governments climate action, but as an independent advisory body, it has no decision-making authority. Beyond the parameters of GLA autonomy laid down by the GLA Act described in Section 3.2, there are no formal processes for vertical coordination. Both the GLA and TfL maintain Government Relations teams that, inter alia, produce briefings, engage with parliamentarians and government officials to promote the mayor's priorities, and manage GLA responses to government consultations [65]. The GLA can also publicly state its position and call on government to act in areas of concern, such as through the mayor's strategies.

3.4.2. Action (Moderately Weak)

As described in Section 3.2, government has issued guidance for the preparation of energy and climate element of the LES. There is no evidence to suggest that the government has required alterations the MTS or LES, but the government directed the mayor to alter the upcoming London Plan (including to relax measures to reduce car ownership and use) [66]. Beyond this, coordination is largely conducted on a case-by-case basis, focusing on large capital investments (e.g., Crossrail). In May 2020, the government announced it would begin trials of rental e-scooters in England. In November 2020, TfL and London Councils jointly announced that they will host a twelve-month trial. The interviewees held a common view that prior to the pandemic, coordination between government and TfL was "not good enough . . . really challenging" (LI-1), as although DfT seeks to encourage low-carbon mobility, "it also has a number of other [objectives]" that can make coordination difficult (LI-4). In addition, government thinking was often "well, just give it to TfL and the GLA and that's dealt with" (LI-5). However, LI-3 and LI-6 believed that coordination improved during the pandemic, with four interviewees citing e-scooter trial discussions as

a positive example, although there have been "heated discussions between DfT and TfL on the nature" of these trials (LI-4).

3.5. Horizontal Coordination

3.5.1. Capacity (Strong)

The GLA Act allows the mayor to make up to 11 appointments, to whom powers and responsibilities may be delegated (with some exceptions, such as the power to direct TfL), At present, there is a Deputy Mayor for Environment and Energy and a Deputy Mayor for Transport. The mayor has also appointed a Walking and Cycling Commissioner, reporting to the Deputy Mayor for Transport. The GLA is also able to constitute advisory bodies, such as the LSDC, established in 2002 to provide independent advice on delivering the GLA's duties on sustainable development [67]. As discussed in Section 3.2, TfL's primary responsibility is to implement the MTS, and it has direct control over London's public transport network, the TLRN, and other non-borough transport functions. The current mayor has appointed himself Chair of TfL, and the Deputy Mayor for Transport as Vice-Chair.

In preparing their strategies, the mayor must consult with the Assembly, GLA's functional bodies (including TfL), and each borough. Although there is no obligation for the views of these bodies to lead to amendments, the mayor must outline which have and have not been accepted, and why. In turn, each borough must conform to the final strategies. For spatial planning, the National Planning Policy Framework (NPPF) states that "local planning authorities are under a duty to cooperate on strategic matters that cross administrative boundaries" [68] (p. 10). The MTS, LES and the London Plan all pledge the mayor to work with the boroughs to deliver their aims [37–39]. In 2018, TfL established a Local Communities and Partnerships Team to provide a single point of contact for boroughs, and to understand how TfL can "better support [boroughs] to ensure [TfL's] strategies are clear and relevant, and take into consideration [borough] needs" [69] (p. 6). TfL has also published a range of guidance and toolkits to help boroughs engage with TfL's campaigns and schemes. The GLA Government Relations Team (discussed in Section 3.4) also works with the boroughs, including "through the Congress of Leaders, where the Mayor discusses key London issues with borough leaders" [65].

The main platform for inter-borough coordination and cooperation is London Councils, a cross-party organisation that "makes the case to government, the mayor and others to get the best deal for Londoners and to ensure that our member authorities have the resources, freedoms and powers to do the best possible job for their residents and local businese" and seeks to act "as a catalyst for effective sharing among boroughs" [70]. It has a dedicated Transport and Environment Committee with members representing each borough and TfL, and operates the London Environment Directors' Network (LEDNet).

3.5.2. Action (Moderately Strong)

Although "London is in a very unique [sic] position, as the mayor is also the leader of the transport authority" (LI-4), LI-3 thought that the political nature of the GLA sometimes produces "political winds that can bash TfL about", creating tension, which has exacerbated during the pandemic. LI-3 also believed that TfL can often see itself as a sister rather than daughter organisation to the GLA, producing further conflict. Together, they believed that this could sometimes lead to a lack of communication and transparency, but overall the "dynamic between GLA and TfL can be both good and bad". A study commissioned by TfL found that although 83% of borough representatives surveyed believed TfL could be trusted, and 78% believed that they communicate openly and honestly, just 51% knew how to effective engage with TfL. Respondents also believed that TfL was too bureaucratic, and that it does not take sufficient notice of borough priorities [69].

LI-5 believes coordination between TfL and the boroughs to be "generally fairly good", although LI-2, 6 and 8 thought it to be a very mixed picture, with LI-3 believing it "haphazard at best". Broadly, although LI-1 feels that coordination is "mostly effective –

the city works, it functions very well", they also feel that the "GLA has no powers over the [boroughs], really at the end of the day, the boroughs will do what they want". LI-6 believes that in order to achieve his goals, the mayor may eventually be forced to compel some boroughs to act, or to take direct control of their LIPs. However, "these tactics are tough and questionable—and not nice options" to have to use (LI-7). So far, interviewees believed that the mayor and TfL have been "unwilling to wield the stick", instead taking "a carrot led approach" (LI-1), in part to avoid raising tensions, as "boroughs don't like that TfL can say yes or no to who gets money for what" (LI-1), yet "TfL cannot deliver without some form of cooperation" (LI-7), as "mobility governance is still quite fragmented, [with the] distribution of responsibilities quite complex" (LI-8). LI-3 believed that where coordination is effective, it is often because "two officers [in TfL and a borough] who know each other have joined the dots". LI-5 stated that some boroughs "are easier in their dealings with TfL than others", in part due to differences in politics and priorities, but also "how well equipped the borough is to deal with transport schemes; if they have good plans, are good at spending the money and meet all the deadlines, then they will have a good relationship with TfL. Those that don't, won't". Similarly, on inter-borough co-operation, LI-4 believed "quite different political objectives make a joined-up approach quite hard to achieve", which is "something than could be improved on a lot" (LI-5). Often, "the relationships aren't the best" (LI-5), leading to issues such as "cycle lines [that] just stop at borough boundaries" (LI-5). LI-2 believed boroughs are not necessarily "making bad decisions, but different decisions", which "gums up the roll-out" (LI-2) of car clubs, dockless bikes and cycle infrastructure, for example.

3.6. Membership of Capacity-Building and Learning Networks

3.6.1. Capacity (Moderately Strong)

London is a member of C40 Cities, a network of 97 megacities that "supports cities to collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change" [71]; the Global Covenant of Mayors for Climate and Energy, "the largest global alliance for city climate leadership, built upon the commitment of over 10,000 cities and local governments" [72]; and the Carbon Neutral Cities Alliance, a "collaboration of leading global cities achieving carbon neutrality before 2050" [73]. In Europe, aside from the European iteration of the Global Covenant of Mayors, London is largely represented by individual boroughs. This includes, for example, CIVITAS, a "network of cities dedicated to cleaner, better transport in Europe and beyond" [74], to which the boroughs of Bromley, Hammersmith and Fulham, Sutton, and the City of London belong, and POLIS, "the leading network of European cities and regions working together to develop innovative technologies and policies for local transport" [75], to which all boroughs are members via the LEPT. In the UK, 15 boroughs belong to UK100, "a network of highly ambitious local government leaders, who have pledged to secure the future for their communities by shifting to 100% clean energy by 2050" [76], and the Association of Directors of Environment, Economy, Planning and Transport (ADEPT), to which the City of London is a direct member, as well as all other boroughs through the LEDNet, with TfL being an associate member.

3.6.2. Action (Strong)

One of the five key principles of the LES is to collaborate "with leading climate change and environmental institutions and other world cities, sharing ideas and learning from best practice" [38] (p. 22), particularly through the C40, which was founded in 2006 in London following a meeting convened by Mayor of London Ken Livingston [77]. London sits on the steering committee, and the Deputy Mayor for Environment and Energy is a board member. London is also a lead signatory to the C40 Fossil-Fuel-Free Streets declaration (which pledges each city to procure only zero-emission buses from 2025, and ensure that a major area of each city is zero emission by 2030) [78], and participates in the C40 Climate Action Planning Framework, which was used to support the development

of London's "1.5 °C Compatible Plan" (discussed in Section 3.8) [79]. London is active in other networks, with GLA officials sitting on two of the three managing committees of the Covenant of Mayors [80]. The mayor and the GLA have "been really active" (LI-5) in the C40 in particular, but largely to showcase action in London, as the city is "very proud of its achievements . . . the creation of TfL and the congestion charge were genuinely admired and admirable" (LI-8). LI-5 believed that London Councils supports many networks, but active participation by boroughs has declined due to funding cuts. However, LI-1 stated that although "sharing leads to doing, often I feel it is just sharing", with LI-2 feeling that there is a "worthwhile entity overload", and often a "lack of joined up thinking among such organisations partly just because of the scale of the problem [of climate change]" (LI-3). LI-4 believed that the sheer size and complex governance structure in London makes learning lessons from other cities difficult.

3.7. Collaboration with and Participation of Stakeholders

3.7.1. Capacity (Strong)

In exercising their statutory authority, in addition to public bodies described in Section 3.5, the mayor must consider consulting bodies representing different racial, ethnic, national and religious groups, and businesses. For the MTS specifically, they must also consult the national Disabled Persons Transport Advisory Committee. Government guidance on preparation of the energy and climate element of the LES encourages the mayor to consult with a range of specific organisations, although none have a focus on transport [28]. Shortly after entering office, the current mayor published "A City for All Londoners", which set out priorities to be fully developed through his strategies, and on which stakeholder views were gathered through workshops, focus groups and discussions via "Talk London" [81], an online platform "where you can have your say on London's big issues" [82]. Drafts of the current LES, MTS and upcoming London Plan were subject to a 14-week public consultation, advertised through the GLA website. For the LES, views were sought through online discussion threads and surveys on Talk London, email campaigns, online forms, focus groups, interviews, representative polling and events. For the MTS consultation, operated by TfL and advertised through the TfL "Consultations Hub", "an extensive marketing and engagement programme to seek the views of Londoners, businesses and stakeholders" [83] took place. TfL also seek views on new guidance, policy, and major projects [84]. The mayor's guidance for LIP preparation states that boroughs "may wish to consult with" (inter alia) elected members and the borough's Director of Public Health, local community, business and transport groups [85] (p. 12).

The MTS, LES, London Plan and 1.5 °C Compatible Plan (discussed in Section 3.8) all repeatedly state that the mayor, the GLA and TfL will work with stakeholders to achieve their objectives. TfL maintain an "innovator database" to which organisations may register to receive information on TfL innovation programmes. TfL have also "committed to making our open data freely available to third parties and to engaging developers to deliver new products, apps and services for our customers", believing that this "facilitates the development of technology enterprises [through] effectively crowdsourcing innovation" [86].

3.7.2. Action (Strong)

When consulting on the LES, the GLA received, inter alia, 5400 survey responses on Talk London, and 370 responses via an online webform [87]. TfL received 43,550 individual comments [83] for the MTS consultation. In both cases, responses were reported and amendments recommended in a publicly available report to the mayor. All recommendations for the MTS were implemented. For all other consultations, TfL publish responses to feedback on their website [84]. Consultation responses to the London Plan were made available online, with an updated plan published following a review of responses [88]. When preparing their LIPs, the mayor requires boroughs to demonstrate that stakeholder views have been considered [85].

Although TfL "went through a time when it had a very patrician approach" to stakeholder engagement (LI-7), it has "generally got a lot better in recent years" (LI-5). LI-3 felt that "TfL does a really phenomenal job [on consultation], at least when it comes to new projects [and] in terms of sincerity, I think it really stands out—pretty much second to none" and responses are often reviewed item-by-item. The "GLA and TfL tries its best to include everyone" (LI-1), and there is "a lot of will to involve different parties" (LI-8), but it is "quite difficult to engage everyone" (LI-8). Although TfL are getting better at seeking "silent" views, this is not seen as a priority (LI-6). Although policy officers at TfL usually weight stakeholder responses based on representativeness (LI-6), the level of attention granted to different groups tends to "wax and wane" over time (LI-2). Taxi drivers were identified as a group that "shout very loud" (LI-6), and used to have a substantial level of influence, but less so now (LI-2 and 7). In general, "boroughs are quite good at listening to different views" (LI-5), but "the management of stakeholder relationships is completely variable" (LI-7). LI-5 felt that the voices listened to largely depend on local politics, as councillors "have to take a political decision on what they're going to risk". Various interviewees raised the emergency measures introduced following pandemic restrictions, many of which were introduced without consultation, and which some boroughs have found difficult as they "are used to talking to their residents before they implement schemes" (LI-5). However, LI-5 believed that both boroughs and TfL have been responsive to concerns, with engagement "happening as part of a live scheme" (LI-7).

TfL has established "Innovation Partnerships" with companies to develop new products and services. This includes the "London Connectory"; a partnership with Bosch to allow small businesses to work with experts and TfL data to develop new transport-related products [89]. TfL have published "problem statements" to source new mobility solutions, and a call to participate in a new "Innovation Collaboration Framework", to allow TfL rapid access to corporate R&D facilities [89]. Around 42% of Londoners use an app with TfL data, across more than 600 apps developed by around 13,000 developers, generating GBP 130 million in economic benefits and savings a year [90]. LI-6 stated that the GLA and TfL are frequently approached by technology companies looking for collaboration, although TfL believe in "being able to fix problems with incumbents and transnational corporations" (LI-8).

3.8. Presence of Local Climate Champion

3.8.1. Capacity (Strong)

As described in previous sections, the mayor holds broad executive power over (particularly public) transport in London, through direct and indirect channels. The London Assembly provides some check and balance through its powers described in Section 3.2, and its ability to investigate any mayoral action, and to submit proposals to the mayor to which a response must be provided. The Assembly must also confirm certain mayoral appointments, including the Chair and Deputy Chair of TfL. The mayor must submit an activity report to the Assembly ten times a year, on which they are questioned. Members of the public directly question the mayor and the Assembly twice a year, and the mayor must also participate in an annual "State of London" debate and publish an annual report on developments and achievements. Although there are few formal curbs on mayoral action on transport within the GLA and TfL's remit (either from the Assembly or government), there is extensive scrutiny. The Mayor of London is one of the most high-profile political positions in the country, with 93% of the British population having heard of the incumbent (the third mayor), Sadiq Khan [91]; with his immediate predecessor, Boris Johnson, now Prime Minister.

3.8.2. Action (Strong)

The mayor aims to achieve zero CO_2 emissions in London by 2050, and has adopted London-wide carbon budgets, following the approach taken by national government [38]. The mayor has set targets of, by 2041, having 80% of all trips in London made by public or

active transport, increasing rail service capacity by at least 80%, and reducing road traffic by 10–15% [39]. The MTS, LES and upcoming London Plan include a core principle of "Healthy Streets", which "provides the framework for putting human health and experience at the very heart of planning the city", to ensure that "individual streets are appealing places to walk, cycle and spend time" [39] (p. 5). Key actions regarding TfL's infrastructure and operations in particular are discussed in previous sections. The strategies contain various other actions to encourage active travel, including delivering a London-wide strategic cycle network with improved infrastructure; encouraging restrictions on vehicle movements; protecting and improving walking routes; imposing expectations on developers to promote active modes; and using data to allow journey planning tools to favour walking and cycling [37–39]. For private transport the mayor aims to have all newly registered vehicles in London zero-emission by 2030, through inter alia, investigating proposals for more sophisticated road user charging systems to replace the LCC and ULEZ; introducing a zero emission zones in central London from 2025, increasing to London-wide by 2050 at the latest; supporting car clubs and reducing private parking; ensuring sufficient charging and refuelling infrastructure for ULEVs, and introducing other regulations and incentives to support their use [37–39].

To support his ambitions, the mayor has suggested further competences to be devolved in addition to those discussed previously, including powers to implement time-limited road closures, greater control of PHV licensing (including the ability to cap numbers), allowing the London Plan to take precedence over national planning policy, and responsibility for suburban rail services [39]. The mayor supports further action at the national level (without which he acknowledges his overarching decarbonisation goal cannot be met), for which his strategies may act as "the template for ambitious action" [38] (p. 6).

An Implementation Plan was published alongside the LES, against which annual progress is reported. The London Energy and Greenhouse Gas Inventory (LEGGI) reports GHG emissions and energy consumption from homes, workplaces and transport in London, and is used to measure progress against emission targets [14]. In December 2018, the London Assembly passed a motion calling on the mayor to "declare a Climate Emergency, supported by specific emergency plans to make London carbon neutral by 2030, [and] call on government to give him the powers and funding to make this possible" [92]. A few days later, the mayor published "Zero Carbon London: A 1.5 °C Compatible Plan", in which he states that "the world is now clearly in the midst of a climate emergency" [93] (p. 6), and outlines the expected impacts of his strategies on CO_2 emissions to 2050, and associated costs. The mayor has announced that if re-elected in 2021, he will aim to make London carbon-neutral by 2030 [94].

The interviewees believed that "Sadiq Khan has made very loud and bold statements on climate" (LI-7), that he "has some pretty ambitious policy targets" (LI-4), and is "definitely providing leadership" (LI-5). While LI-6 believed that the introduction of the ULEZ was a good example, others would "like to have seen a lot more" (LI-1) and felt that if is "not a political winner, the mayor tends not to really push TfL" (LI-3). To date, 26 of 32 boroughs have declared a "climate emergency", with many aiming for net-zero emissions from their own operations by 2030 [95]. Although "some boroughs are showing quite a lot of leadership" (LI-5), others "don't seem willing to engage on the climate crisis" (LI-7), with climate emergency declarations "very quickly falling to the sidelines" (LI-4), often due to lack of funding, although some simply "aren't [keen to push] the mayor's agenda" (LI-3).

3.9. Conducive Urban Form and Infrastructure (Moderately Strong)

With a population density of 5700/km², London is by far the most densely-populated English region [96], and more dense than comparable regions for Paris, New York and Berlin, but less dense than Hong Kong, Singapore and Tokyo [97]. London is considered polycentric; in assessing journeys on the underground network, Roth, Kang, Batty and Barthélemy found three "core" centres of activity, and a further seven secondary centres

in central London [98]. However, other centres may emerge if this analysis is extended to include other modes. LI-7 felt that "London is, amazingly for its size, incredibly well configured" for the transition; by contrast, LI-3 believed that "of major [world] cities, [London is] one of the most ill-suited to this transition that I've come across". LI-4 and 7 both believed that London's size "presents some challenges" (LI-7), and as London "is one of the oldest cities in the world with pipes and tunnels everywhere", reconfiguration is "very hard and very expensive" (LI-1). LI-2 believed that the underground network forms the "spine of low-carbon mobility in London". Although LI-4 agreed that the Underground and wider public transport system is "incredibly comprehensive, incredibly vast", it is also "incredibly centralised", in that it is designed to move as many people into the centre as efficiently as possible. Despite the conclusions of Roth et al. [98], there is a common view that "London is a very unicentric city [with] everybody commuting into the centre" (LI-3), and that "parts of outer London are very underserved by public transport" (LI-4), which alongside issues such as fewer pavements (LI-6), means that such areas are "much more car dominated and car dependent, even more so than many people believe" (LI-8). Although expanding the Underground would be difficult in a "very complicated subterranean world", improving bus connectivity has substantial funding implications (LI-2). LI-3 felt the pandemic may facilitate "real shifts in behaviour", particularly with home working, leading to London re-emerging as a "collection of villages", (LI-7), with more investment in areas that people both live and work (LI-1), potentially entrenching new mobility habits (LI-4).

3.10. Societal Pressure (Moderately Strong)

In June 2020, 81% of UK adults were concerned about climate change, with just 3% unconcerned [99]. Prior to the pandemic, the environment was perceived as the third most important issue facing the country, after Brexit and healthcare (and above the economy) [100], with around half the population (higher in urban conurbations such as London) concerned about air pollution from road transport [101]. Following nationwide 'lockdown' restrictions introduced in March 2020, concern over COVID-19 was greater than for climate change, but a majority believed that government should prioritise reviving the economy and tackling climate change equally once the pandemic recedes [102]. In July 2020, a third of the English population felt the pandemic had made them more concerned about climate change and air pollution (with 8% less concerned) [103]. However, over 80% of the English adult population are wary of using public transport since the pandemic began, with less than a quarter having concerns over the use of private cars, or walking and cycling. Around 40% of people are walking and cycling more compared to pre-pandemic, with almost all planning to maintain this into the long term [101,103]. In London specifically, 39% of people believe that they would use public transport less once restrictions are lifted [104], with around 90% of people concerned about using the Underground [103]. Londoners strongly approve of the mayor's transport policies, with a majority supporting measures introduced during the pandemic [105]. Polls also suggest that the mayor is substantially more popular than his nearest rival for the next mayoral term [106].

Societal pressure for climate action in London "has certainly gone up" over time (LI-8), although there is "never as much as you'd hope" (LI-1), and "the difference is stark between inner and outer boroughs" (LI-3), with the former typically much more in favour of action. However, LI-8 felt that low-carbon mobility, and particularly cycling, had become embroiled in a broader "culture war", linked to gentrification and issues of mobility justice. LI-1 and 4 believe that commercial interests tend to be against measures to change transport behaviour, although LI-5 noted that once such measures have been introduced, opposition tends to diminish. LI-6 believed that due to the pandemic "fear [of public transport] may now stick in people's minds", and if this does not change, it "will have huge implications" (LI-8).

4. Conclusions

Table 3 summarises the scores awarded to each enabling factor and lens. London's city authorities have a strong capacity for autonomy and stakeholder participation, and for an effective local climate champion to emerge. In each of these cases, it takes clear advantage of these capacities to encourage low-carbon passenger mobility. City authorities can and do raise substantial funds for low-carbon mobility, although discretionary spending is limited by obligations to maintain London's extensive public transport network, and the lack of external financial support. This has been exacerbated since the onset of the COVID-19 pandemic, as public transport fare income fell drastically. Emergency finance deals with the government may have long-term implications for London's autonomy over passenger mobility, which run counter to local demands for greater devolution. The UK's legal and political environment is largely supportive of urban climate action, particularly through its net-zero emissions target, but the policy framework focuses on reducing CO_2 emissions from passenger vehicles, with lacunae in public and active transport. There are also few processes for vertical co-ordination between national and local decision-makers.

Table 3. Summary of assessment scores.

Enabling Factor	Capacity				Action			
	W	MW	MS	S	W	MW	MS	S
Supportive political and legal context	▰	▰	▰		(n/a)	(n/a)	(n/a)	(n/a)
Autonomy	▰	▰	▰		▰	▰	▰	▰
Access to funding for climate action	▰	▰	▰		▰	▰	▰	▰
Vertical co-ordination	▰				▰	▰	▰	
Horizontal co-ordination	▰	▰	▰		▰	▰	▰	▰
Membership of capacity-building and learning networks	▰	▰	▰		▰	▰	▰	▰
Collaboration with and participation of stakeholders	▰	▰	▰		▰	▰	▰	
Presence of local climate champion	▰	▰	▰		▰	▰	▰	
Conducive urban form and infrastructure	▰	▰	▰		(n/a)	(n/a)	(n/a)	(n/a)
Societal pressure	▰	▰	▰		(n/a)	(n/a)	(n/a)	(n/a)

Note: ('W' = Weak; 'MW' = Moderately weak; 'MS' = Moderately strong; 'S' = Strong; grey shading = not applicable).

Despite two administrative levels with complex and interdependent roles and responsibilities, there are robust and varied processes for coordinated climate action on passenger mobility in London, owing primarily to the presence of a single public transport operator under direct influence of the mayor. These processes generally work well, although the mayoralty has been politically reluctant to use its most forceful levers to drive action by recalcitrant boroughs. Public and political attitudes differ between inner- and outer-London boroughs, with the former typically more disposed towards climate action and low-carbon mobility. This may be substantially linked to urban form; although London's public transport network is vast and multi-modal, its infrastructure is concentrated in the centre, with peripheral boroughs more car-dominated.

Although CO_2 emissions from passenger mobility in London are declining, much more rapid progress is required to achieve net-zero emissions; particularly if this aim is brought forward from 2050 to 2030. The analysis presented by this paper does not seek to assess whether the measures taken by London's city administration are sufficient or appropriate to achieve these aims, but whether the governance arrangements are sufficient to facilitate them. On this basis, although a broadly positive assessment is made across most enabling factors, two key areas of deficiency remain. First, the UK government must provide a more supportive policy framework at the national level for rapid decarbonisation in this sector, with much improved co-ordination and funding for local authorities—including the GLA and London boroughs—that must take much of the granular action to achieve it. Secondly, action must be taken to improve horizontal co-ordination within London, to accelerate efforts by boroughs to implement and achieve the mayor's policies and targets. This is particularly the case with outer boroughs, which remain car-dominated. However, such

action exceeds issues of process and policy, and more firmly enters the realm of politics, strongly influenced by the preferences of the local populace and the form of the urban environment they inherited.

The COVID-19 pandemic may transpire to be a transformative event, addressing both of these deficiencies to some degree. The pandemic has drastically reduced public transport use in London, in favour of both private cars and active travel, with large numbers of people now working from home. The extent to which these trends can be altered or embraced to drive low-carbon mobility in London in the long-term is an open question, and one which requires governance structures and processes to be at their most facilitative to address effectively.

The framework applied by this paper provides a flexible approach to generating a snapshot of the strengths and weaknesses of governance arrangements for climate action. However, it relies to a substantial degree on subjective judgement, and does not assess whether these arrangements have produced effective action. Future work to expand this framework to incorporate analytical frameworks on the characteristics of policy mixes (e.g., [107,108] would allow a more rounded view of the policy environment for climate action at the city level). Adapting the framework to apply to other areas of environmental concern, particularly local air pollution, would also likely prove useful.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of the UCL Bartlett School of Environment, Energy and Resources (approved 16 July 2020). Data protection reference number. Z6364106/2020/07/108.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the protection of data provided by annonymised interviewees.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Semi-Structured Interview Questions

1. Do you believe that there is a supportive political and legal context (i.e., in higher levels of governance) for the transition to low-carbon mobility in London?
2. To what degree do you believe London has sufficient autonomy to introduce appropriate policy strategy, mechanisms and instruments to drive the transition to low-carbon mobility in London? Do you believe that city authorities make use of the autonomy that is afforded?
3. To what degree do you believe that London has access to funding for action to develop low-carbon mobility (from any source)? To what degree do you think the city authorities use the funding they may raise or receive for this purpose?
4. To what degree do you feel that there is effective co-ordination between low-carbon mobility policy action at the city level, and higher levels of governance (e.g., national and EU)?
5. To what degree do you feel there is effective co-ordination on low-carbon mobility policy between different city-level bodies, and London boroughs?
6. To what degree do you feel that London participates in capacity-building and learning networks and processes, with regard to low-carbon mobility in particular?

7. To what degree do you feel that city authorities engage or collaborate with stakeholders in developing and implementing policy and initiatives relevant to low-carbon mobility in London? Do you feel that engagement with a wide range of stakeholder groups is sought, and to what degree do you feel such engagement influences the design and operation of policy and initiatives?
8. To what degree do you feel city-level leaders are providing support and leadership for the development of low-carbon mobility in London?
9. To what degree do you believe that the urban form and pre-existing infrastructure in London is suited to the transition to low-carbon mobility in London?
10. To what degree do you believe that there is societal pressure for London to drive the transition to low-carbon mobility in the city?
11. To what degree to you believe that the above factors have changed, or are likely to change, in the near to medium-term, as a result of actions to tackle the direct or indirect effects of COVID-19?

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